

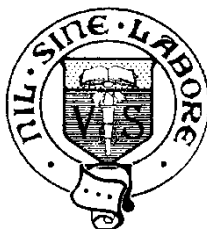
Class

Register Number

Name

**6092/01
CHEMISTRY****24/S4PRELIM/6092/1****PAPER 1****Tuesday****9 September 2024****1 hour**

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**VICTORIA SCHOOL****PRELIMINARY EXAMINATION
SECONDARY FOUR**

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Write your name, class and index number on all the work you hand in.

Do not use staples, paper clips, glue or correction fluid.

There are **forty** questions on this paper. Answer **all** questions. For each question, there are four possible answers **A, B, C** and **D**.

Choose the one that you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

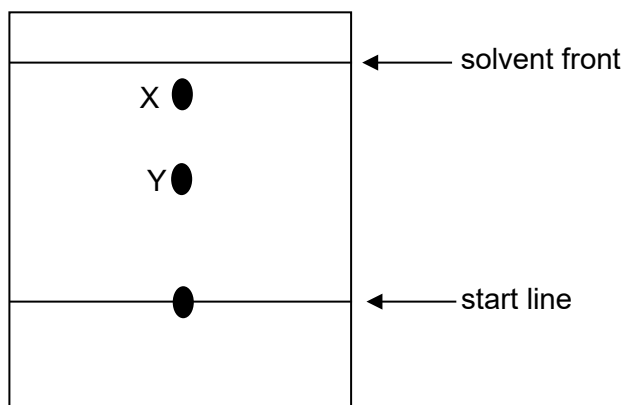
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.

A copy of Periodic Table is printed on **page 15**.

The use of an approved scientific calculator is expected, where appropriate.

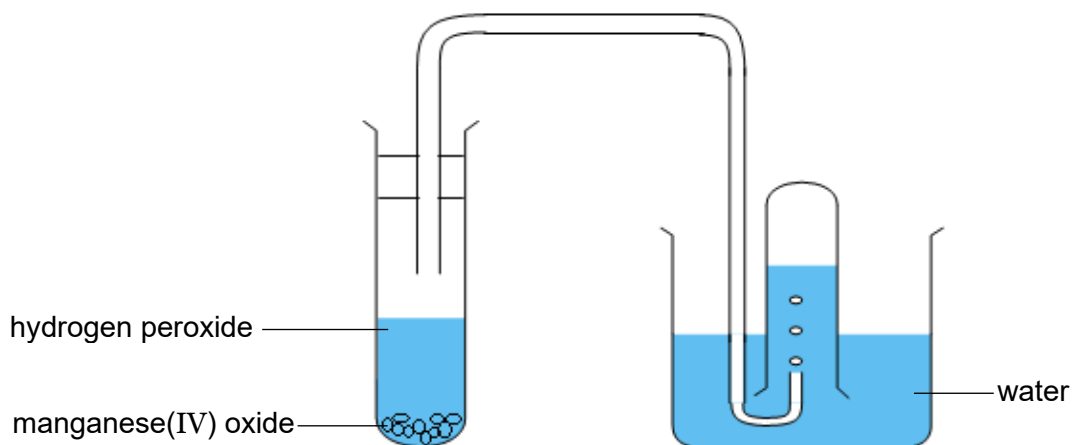
This question paper consists of 15 printed pages, including the cover page.**[Turn Over]**

- 1 A chromatogram was prepared using a mixture of substances. After drying, the chromatogram is shown in the diagram.



Which statement is correct?

- A Locating agents are always needed to interpret a chromatogram.
 - B There are only two substances present in the mixture.
 - C The chromatogram is placed with start line above the solvent.
 - D The substance at level X has a lower R_f value than the substance at level Y.
- 2 Oxygen was prepared and collected using the apparatus as shown in the diagram below.

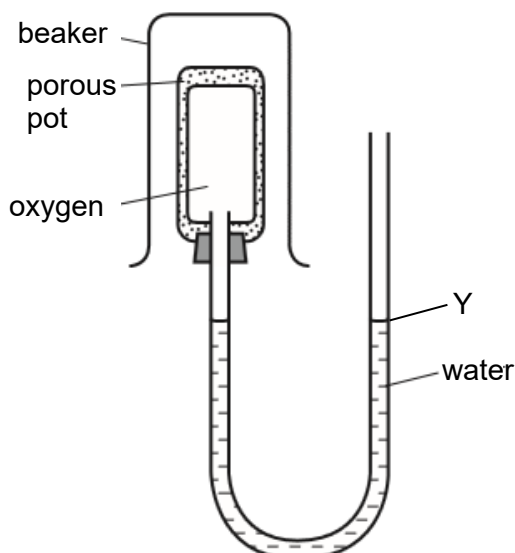


The first tube of gas collected was discarded as it was contaminated.

Which contaminant was in the gas?

- A hydrogen
- B hydrogen peroxide
- C manganese(IV) oxide
- D nitrogen

- 3 The diagram shows a diffusion experiment.



Which gas, when present in the beaker, will cause the water level at Y to rise the most?

- A carbon dioxide
 - B helium
 - C nitrogen
 - D water vapour
- 4 An unknown substance X starts melting at -180°C and finishes melting at -160°C .

What is substance X likely to be?

- A a compound
 - B a mixture
 - C an element
 - D insufficient data to determine
- 5 Which of the following statements about isotopes is correct?
- A Isotopes are atoms of the same element with the same number of protons but different number of electrons.
 - B Isotopes are atoms of the same element with the same number of protons but different number of neutrons
 - C Isotopes are atoms of the same element with the same number of neutrons but different number of electrons.
 - D Isotopes are atoms of the same element with the same number of neutrons but different number of protons.

- 6 The table shows the number of sub-atomic particles in four different ions.

Which ion has the correct number of sub-atomic particles shown?

	ion	number of sub-atomic particles		
		protons	neutrons	electrons
A	$^{37}_{17}\text{Cl}^-$	17	20	18
B	$^{64}_{29}\text{Cu}^{2+}$	29	35	31
C	$^7_3\text{Li}^+$	4	4	2
D	$^{14}_7\text{N}^{3-}$	7	14	10

- 7 Heavy water is made up of 2 deuterium (^2H) atoms and 1 oxygen atom.

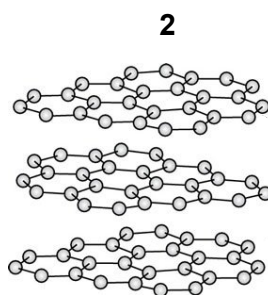
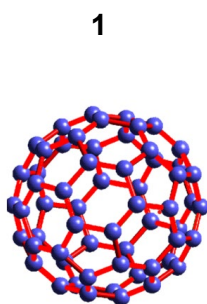
Which properties are true about heavy water?

- 1 Its boiling point is higher than 100°C .
- 2 It reacts with sodium to form sodium hydroxide and hydrogen gas.
- 3 It can act as a solvent for sodium chloride.

- A** 1 only **B** 2 and 3 only **C** 1, 2 and 3 **D** none of the above

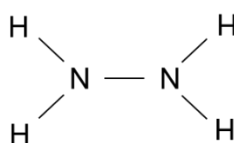
- 8 The diagram below shows the structures of 3 substances. All the atoms in each structure are made up of the same element.

Which of the following substance(s) can be used as an electrode?



- A** 2 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3

- 9 The structure of hydrazine is shown below.



How many pairs of unbonded electrons are there in a hydrazine molecule?

- A** 0 **B** 2 **C** 4 **D** 8

10 Which substances contain the same number of atoms?

- 1 1.20 mol of NH_3
- 2 1.445×10^{24} molecules of O_2
- 3 36.0 g of $\text{C}_6\text{H}_{12}\text{O}_6$
- 4 57.6 dm^3 of Cl_2

A 1 and 2 only **B** 1 and 3 only **C** 2 and 4 only **D** 1, 2, 3 and 4

11 Calcium nitrate crystals contain water of crystallisation. Its formula may be written as $\text{Ca}(\text{NO}_3)_2 \cdot n\text{H}_2\text{O}$.

When a 7.00 g sample of hydrated calcium nitrate is heated to remove all water, 4.90 g of anhydrous calcium nitrate remains after heating.

What is the value of n ?

A 1 **B** 2 **C** 3 **D** 4

12 Copper is obtained from copper-bearing ores.

Below are a list of copper-bearing ores and their formulae.

Given 1 g of ore, which will produce the most copper?

- A** azurite, $\text{Cu}_3(\text{CO}_3)_2(\text{OH})_2$
- B** chalcocite, Cu_2S
- C** chalcopyrite, CuFeS_2
- D** malachite, $\text{Cu}_2\text{CO}_3(\text{OH})_2$

13 20 cm^3 of oxygen is reacted with 50 cm^3 of hydrogen.

What are the volumes of gases, measured at room temperature and pressure, remaining at the end of the reaction?

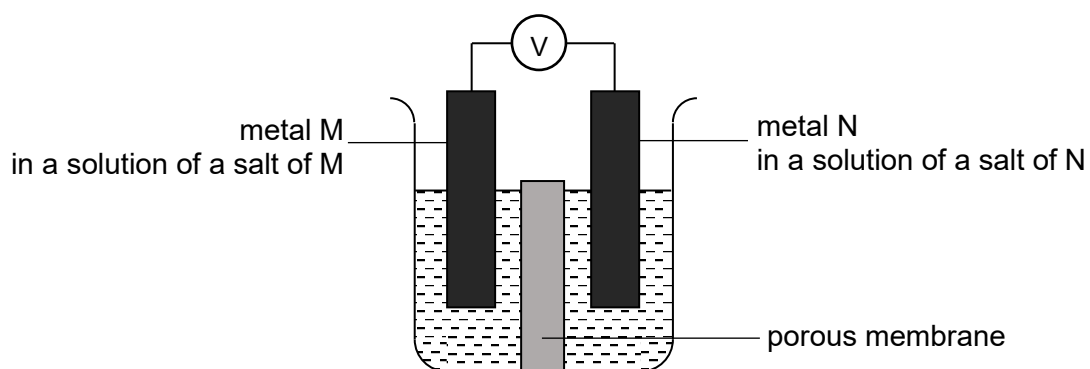
	<u>volume of oxygen</u> cm^3	<u>volume of hydrogen</u> cm^3	<u>volume of product</u> cm^3
A	0	10	0
B	0	10	40
C	5	0	50
D	10	0	40

- 14** Dilute potassium iodide solution is electrolysed using inert electrodes.

What are the observations at the cathode and the anode?

	cathode	anode
A	colourless gas	brown solution
B	colourless gas	colourless gas
C	grey solid	brown solution
D	grey solid	purple gas

- 15** A simple cell is set up as shown in the diagram below.

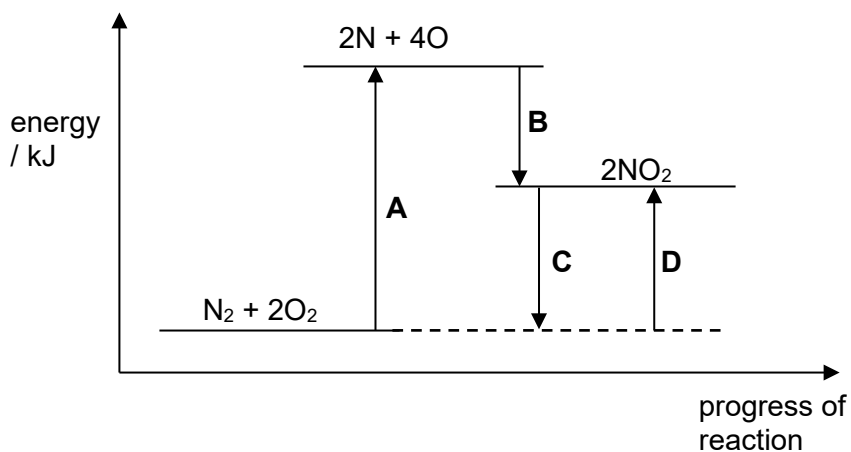


Which pair of metals M and N will produce the highest voltage when used as electrodes in the simple cell?

	metal M	metal N
A	copper	silver
B	magnesium	iron
C	magnesium	silver
D	tin	iron

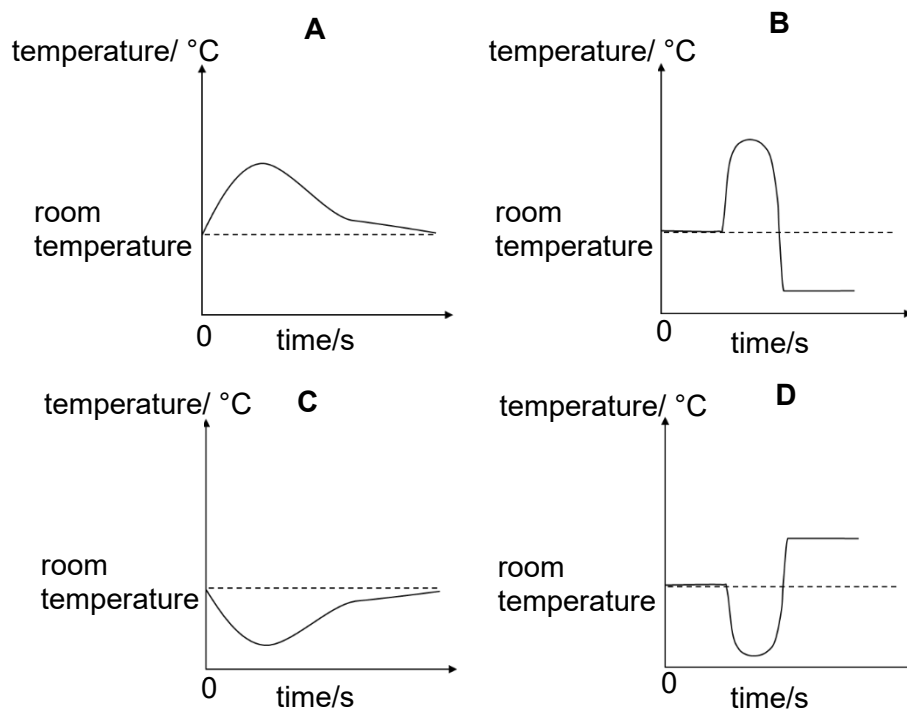
- 16** The energy level diagram of a reaction is shown below.

Which arrow represents the overall enthalpy change of the reverse reaction?



- 17** Dissolving ammonium nitrate in water is endothermic.

Which graph shows how the temperature of the solution alters as ammonium nitrate is added and then the solution is left to stand for some time?

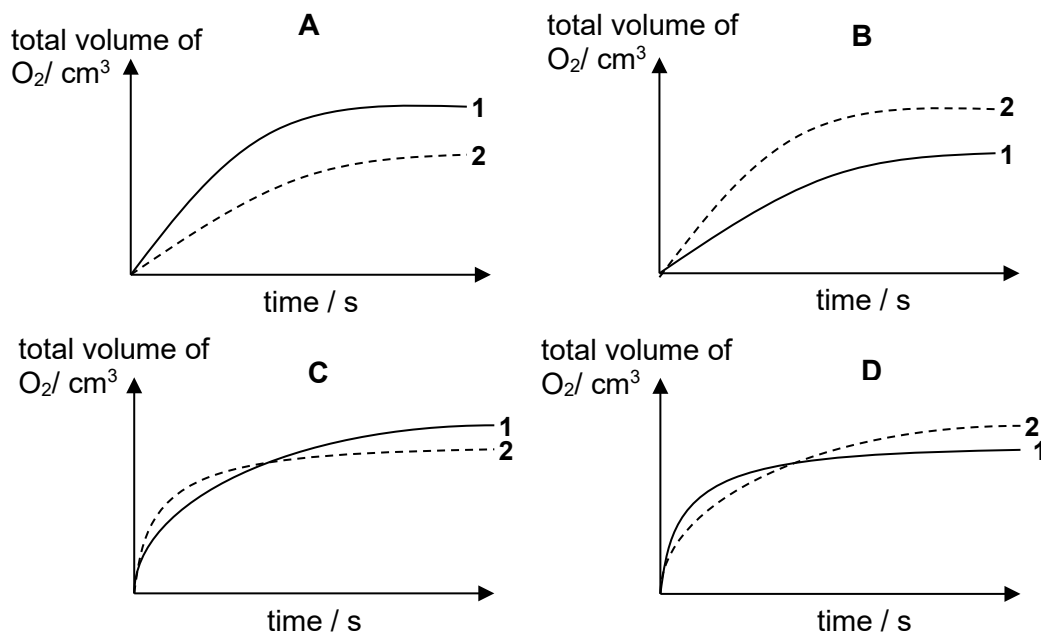


- 18** Aqueous hydrogen peroxide decomposes to form water and oxygen gas.

Two experiments were carried out to measure the rate of production of oxygen from aqueous hydrogen peroxide.

experiment	solution used
1	100 cm ³ of 1.0 mol/dm ³ hydrogen peroxide
2	150 cm ³ of 0.8 mol/dm ³ hydrogen peroxide

Which graph best shows the results obtained?



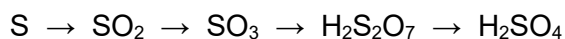
- 19** Which of the following correctly describe the effects which increasing temperature and using catalyst have on ΔH and E_a on the overall reaction?

	increasing temperature		using catalyst	
	ΔH	E_a	ΔH	E_a
A	decrease	decrease	unchanged	decrease
B	increase	increase	decrease	decrease
C	unchanged	decrease	unchanged	decrease
D	unchanged	unchanged	unchanged	decrease

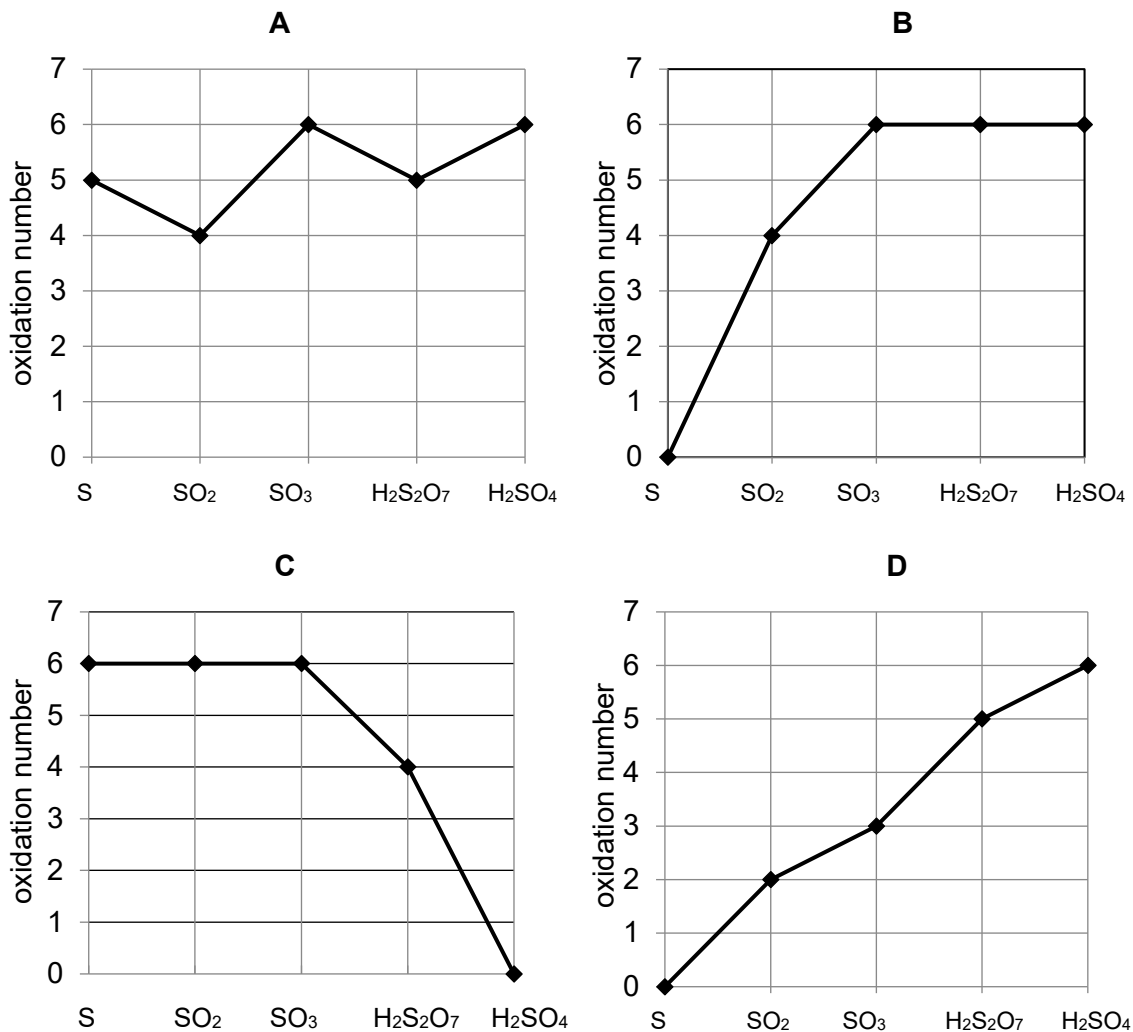
- 20** Which of the following is an example of a redox reaction?

- A** $\text{Ca(OH)}_2 + 2\text{HCl} \rightarrow \text{CaCl}_2 + 2\text{H}_2\text{O}$
- B** $\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$
- C** $\text{Mg(NO}_3)_2 + \text{Na}_2\text{CO}_3 \rightarrow \text{MgCO}_3 + 2\text{NaNO}_3$
- D** $\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$

- 21 The reaction for the manufacturing of sulfuric acid can be represented as follows.



Which of the following graphs correctly shows the oxidation number of sulfur at each stage of the process?

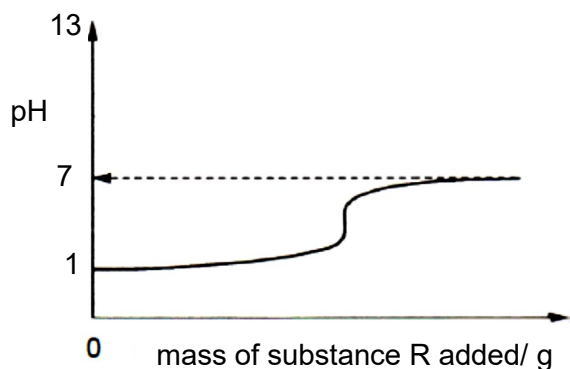


- 22 When excess aluminium oxide, Al_2O_3 was added to a portion of dilute sodium hydroxide.

Which of the following correctly describes the pH change and the explanation?

	pH	explanation
A	decreases	aluminium oxide is an amphoteric oxide
B	decreases	aluminium oxide is a basic oxide
C	increases	aluminium oxide is an amphoteric oxide
D	no change	aluminium oxide is insoluble in water

- 23** Substance R was added bit by bit, with stirring, to aqueous solution S. The changes in pH of the mixture are shown in the graph below.



What could R and S be?

	substance R	substance S
A	sodium oxide	ethanoic acid
B	sodium oxide	hydrochloric acid
C	zinc oxide	ethanoic acid
D	zinc oxide	hydrochloric acid

- 24** What is the total number of sulfates that could be prepared by the reaction of dilute sulfuric acid with the following substances?

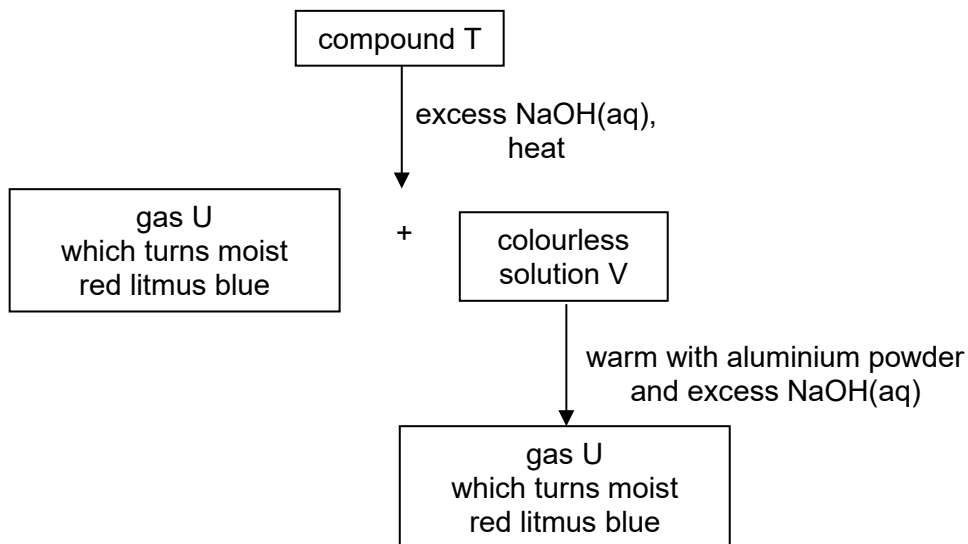
- barium nitrate
- carbon dioxide
- magnesium carbonate
- silver

A 0 **B** 1 **C** 2 **D** 3

- 25** Which three salts are all prepared by titration?

- A** aluminium nitrate, iron(III) chloride, zinc sulfate
B barium nitrate, iron(II) chloride, lead(II) sulfate
C calcium nitrate, copper(II) sulfate, magnesium chloride
D lithium sulfate, potassium chloride, sodium nitrate

- 26 The flowchart shows some reactions of a compound T.



What could compound T be?

- A aluminium carbonate
 B ammonium nitrate
 C calcium nitrate
 D zinc carbonate
- 27 An unknown solid Q has the following properties.
- When aqueous sodium hydroxide is added until in excess to the solution, no visible reaction is observed.
 - When dilute acid is added to Q, effervescence of a colourless gas is observed.
 - Q dissolves in water to form a colourless solution.
 - Q is stable to heat.

What is Q likely to be?

- A ammonium carbonate
 B copper(II) hydroxide
 C sodium carbonate
 D zinc carbonate
- 28 In moving across Period 3 from Group 1 to Group 17, the elements
- 1 have mass numbers differing by one unit from the previous element.
 - 2 have oxides whose property change from acidic to basic.
 - 3 show a gradual transition in properties from metallic to non-metallic.

Which of the following statements are true?

- A 1 and 2 only B 2 only C 3 only D 1 and 3 only

- 29** A warship had its hull plated in copper to protect its wooden hull from rotting. However, after 2 years at sea, it was found that the iron parts of the warship in contact with the copper plates were more corroded than normal.

What is the best explanation for this observation?

- A** Copper acts as a catalyst to speed up corrosion.
- B** Copper reacts with the iron to increase corrosion.
- C** Iron displaces copper to form iron(III) oxide.
- D** Iron is more reactive and corrodes in place of copper.

- 30** Which statement about transition elements is correct?

- A** All catalysts are transition elements or their compounds.
- B** They can donate different numbers of electrons in different compounds.
- C** They form only coloured compounds.
- D** They have high melting points due to strong attraction between opposing ions.

- 31** Which of these Group 1 elements reacts most violently with water?

- A** caesium **B** lithium **C** potassium **D** rubidium

- 32** Carbon monoxide, oxides of nitrogen and sulfur dioxide are gases which have an adverse impact on the environment.

Which of the following correctly show the sources of these gases?

	carbon monoxide	oxides of nitrogen	sulfur dioxide
A	incomplete combustion of fossil fuels	car engines	volcanic eruptions
B	incomplete combustion of fossil fuels	lightning activity	car engines
C	volcanic eruptions	car engines	acid rain
D	volcanic eruptions	lightning activity	car engines

- 33** An enclosed container containing only ammonia gas was slowly heated from room temperature to 450 °C, in the presence of finely divided iron.

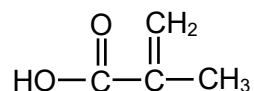
What are the gas(es) which may be found in the enclosed container at 450 °C?

- A** ammonia only
- B** nitrogen and ammonia only
- C** nitrogen and hydrogen only
- D** nitrogen, hydrogen and ammonia

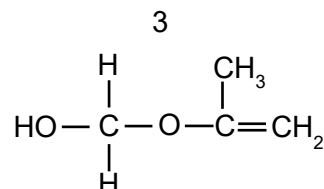
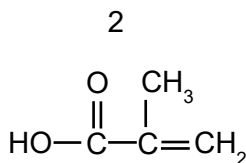
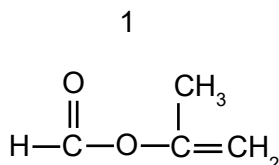
34 Which of the following hydrocarbons would produce the sootiest flame when burnt in air?

- A** CH_4 **B** C_4H_{10} **C** C_8H_{18} **D** $\text{C}_{12}\text{H}_{26}$

35 A compound, R, with the molecular formula $\text{C}_4\text{H}_6\text{O}_2$ has a structural formula as shown below.

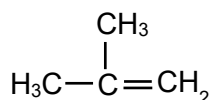


Which of the following is/are isomer(s) of compound R?



- A** 1 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3

36 The structural formula of a hydrocarbon is shown below.



Which statements about the hydrocarbon are correct?

- 1 It can be polymerised.
- 2 It can undergo substitution with bromine under UV light.
- 3 It forms ethanol by the catalysed addition of steam.
- 4 It reacts with chlorine by addition.

- A** 1 and 2 only **B** 1 and 3 only **C** 1, 2 and 4 only **D** 2, 3 and 4 only

37 In which reaction does the relative molecular mass of the organic compound decrease?

- A** conversion of ethanoic acid into ethyl ethanoate
B fermentation of glucose into ethanol
C formation of ethanol from ethene
D oxidation of ethanol into ethanoic acid

- 38** A student claimed that the esterification reaction is a neutralisation reaction.

Which of the following responses is correct and gives the correct explanation?

	response	explanation
A	agree	The acid is reacted away to form a new compound.
B	agree	Water is a product.
C	disagree	The acid does not dissociate to form H^+ ions.
D	disagree	An alkali is absent in the reactants.

- 39** Which of the following monomers reacts with the monomer, $HO-\square-OH$, to form Terylene?

- A** $CH_3(CH_2)_4NH_2$
B C_6H_5COOH
C $H_2N-(CH_2)_8-NH_2$
D $HOOC-C_6H_4-COOH$

- 40** Which of the following is the process in which a polyester is broken down into its monomers?

- A** condensation
B esterification
C hydrolysis
D polymerisation

End of Paper

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The Periodic Table of Elements

Group																							
1	2	1 H hydrogen 1												13	14	15	16	17	18				
		Key																					
		proton (atomic) number atomic symbol name relative atomic mass																					
3 Li lithium 7	4 Be beryllium 9																	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24																	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84						
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131						
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids		72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —					
87 Fr francium —	88 Ra radium —	89–103 actinoids		104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganeson —					
lanthanoids		57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175							
actinoids		89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —							

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$.